PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-285963
(43)Date of publication of application : 19.10.1999

(51)Int.Cl. B24B 37/00
B24B 37/04
H01L 21/304

(21)Application number : 10-103934
(22)Date of filing : 31.03.1998

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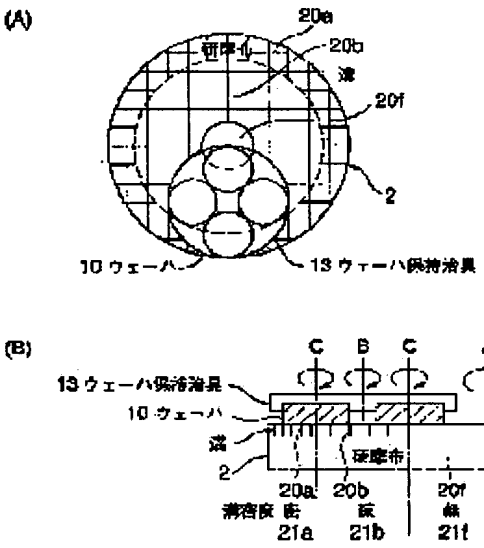
(54) POLISHING BODY COMPOSED OF WAFER POLISHING CLOTH OR POLISHING SURFACE PLATE AND WAFER POLISHING METHOD USING SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To improve flatness of a polished wafer by providing grooves on a wafer sliding surface of a polishing body for every specified intervals, and increasing a density of the groove at a portion where a circumferential speed is high rather than a density of the groove at a portion where a circumferential speed is low.
SOLUTION: A density of groove formed on a wafer sliding face of a polishing cloth 2 is increased from a center 21 toward a peripheral edge. In this lattice-shaped groove density, setting is made such that the center 21 has no groove 20f, a portion outside thereof 21b has a non-dense groove 20b, and an outermost portion has a dense groove 20. Intervals between the grooves are set such that a wafer 10 positioned at a center side retained by a wafer holding jig spans between the grooveless portion 20f and the non-dense groove portion 20b, and a wafere positioned at an outer side spans between the non- dense groove portion 20b and the dense groove portion 20a. Accordingly, a more desirable following rotation of wafer 10 and surface flatness thereof are attained.



LEGAL STATUS

[Date of request for examination]	11.09.2001
[Date of sending the examiner's decision of rejection]	06.04.2004
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2004-09329
[Date of requesting appeal against examiner's decision of rejection]	06.05.2004

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The polish object for wafer polish characterized by making the slot consistency of a part with a large peripheral velocity of this polish object increase to the slot consistency of the part where peripheral velocity is small while establishing a slot in the wafer sliding surface of said polish object for every predetermined spacing in the polish object which consists of the abrasive cloth or the turn table which grinds this wafer, making it slide with the relative speed difference between wafers.
[Claim 2] The polish object for wafer polish characterized by making the slot consistency like this polish object periphery flank increase to the slot consistency located in the inside while establishing a slot in the wafer sliding surface of said polish object for every predetermined spacing in the polish object which consists of the abrasive cloth or the turn table which grinds this wafer, making it slide with the relative speed difference between wafers.
[Claim 3] The wafer polish approach characterized by to grind a wafer using the polish object to which the slot consistency of a large part was made to increase the consistency of the slot established in the wafer sliding surface of said polish object to the part where polish object peripheral velocity is small in the wafer polish approach which grinds this wafer while making it slide with the relative speed difference between the polish objects which consist of a wafer, abrasive cloth, or a turn table.
[Claim 4] the consistency of the slot which established in the wafer sliding surface of said polish object in the wafer polish approach which grinds this wafer while making it slide with the relative speed difference between the polish objects which consist of a wafer, abrasive cloth, or a turn table -- polish -- the inside of the body -- the wafer polish approach characterized by to grind a wafer using the polish object to which received at least the core and the slot consistency of a periphery part made increase.
[Claim 5] The wafer polish approach characterized by grinding a wafer using the abrasive cloth to which the slot consistency was changed in the direction which it is stabilized [direction] and makes a wafer rotate, without making the slot consistency prepared in the wafer sliding surface of said abrasive cloth fixed-ize in the wafer polish approach of pushing against abrasive cloth the wafer stuck on the backing pad by the wax free-lancer, and graduating the irregularity of a wafer.
[Claim 6] In the wafer polish approach of taking a wafer and rotating it the surroundings while making the wafer maintenance fixture held for a wafer, enabling free rotation rotating and revolving around the sun relatively to the abrasive cloth or the turn table stuck on the rotation surface plate The wafer polish approach characterized by grinding a wafer using the polish object to which the consistency of said slot was changed so that the frictional force which acts in the direction of the circumference of a companion of a wafer might become large, without making the slot consistency prepared in said abrasive cloth or the wafer sliding surface of a turn table fixed-ize.
[Claim 7] So that between about a dense slot may be relatively straddled with a **** slot having no wafer fang furrow located in a polish object to two or more wafers held at the wafer maintenance fixture with ** at a core side in a slot consistency in the shape of a ring if it is **, or relatively The wafer polish approach characterized by setting up slot spacing, respectively so that the wafer located outside may straddle between about a dense slot relatively with a **** slot.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the wafer polish approach using the polish object and this polish object which consist of the abrasive cloth or the turn table for a wafer especially a semiconductor wafer, and single-crystal-silicon wafer polish.
[0002]
[Description of the Prior Art] Generally, after performing slice cutting and beveling for a cylinder-like ingot, while a wafer carries out rubbing of a polish (lap) surface plate and the AZUKATTO wafer through the polish liquid containing an abrasive grain, it wraps, and the this wrapped wafer is led to a finish-machining process, after etching processing is carried out. It sets at a finish process and is SiO2 between a polish (polishing) cloth and a wafer. Mirror polishing is carried out by the so-called chemical machinery-grinding method using the polishing liquid which made the system particle suspend in weak lye.
[0003] Although there is the wax method for using the wax for wafer adhesion and sticking wafer one side on the plate for polish as an approach of holding a wafer in this mirror polishing, since the heterogeneity of the thickness of a glue line (wax layer) reflects the flatness of the wafer after polish, parallelism, etc. as it is, in this wax method, it is important to make glue line thickness into homogeneity. Moreover, since it was necessary to remove a wax from a wafer after wafer polish and the drug solution which a process becomes complicated and is used for ** and removal of a wax, and the waste fluid processing facility were needed, there was a trouble that processing cost went up.
[0004] Although the wax loess method is what canceled the fault of the describing [above] wax method and the wax loess method of **** squirrel **** 2 is used in the wafer using the backing pad which serves as the 1st wax loess method by vacuum adsorption from porous resin, for example, a polyurethane resin porous body, there is the advantage to which spreading of the wax to the wafer which described all above, and removal become unnecessary.
[0005] The wax free polish equipment using a backing pad The bottom rotary table 1 which stuck abrasive cloth 2 (polishing pad) as shown in drawing 4 , Two or more polishing heads 4 in which the wafer maintenance fixture 13 with which the wafer 10 was held through the carrier plate 3 and the backing pad 6 at two or more hole (maintenance hole) 11a for wafer positioning at the inferior-surface-of-tongue side was attached, It is polish equipment which becomes said abrasive cloth 2 from the slurry tubing 5 which supplies a slurry (polish suspension), pushes a wafer 10 against the abrasive cloth 2 by the side of a rotary table 1, and graduates the irregularity of a wafer.
[0006] And using the template 7 which has one or more hole 11a for wafer positioning on the carrier plate 3, a backing pad 6 goes into the hole for positioning, and the wafer maintenance fixture 13 used for this equipment is formed so that it may be made to fix. Moreover, the template 7 is formed from the glass epoxy resin, the polycarbonate sheet, the polyester sheet, etc., and the backing pad 6 is formed, porous resin, for example, polyurethane resin porous body.
[0007] And the polishing head 4 self-revolves around the sun to the bottom rotary table 1 which stuck abrasive cloth 2, and a wafer 10 is taken about within the wafer maintenance fixture 13, and is constituted pivotable. It takes here and **** is the phenomenon in which centrifugal-force distribution will arise in the field of a wafer maintenance fixture if the wafer maintenance fixture 13 which has other revolving shafts on a rotary table 1 is placed, and a wafer maintenance fixture rotates according to the difference of a centrifugal force. Namely, by arranging to the center of rotation of a rotary table 1 in drawing 4 in the location which displaced the center of rotation of two or more polishing heads 4 to radial, and rotating both of each other in the direction of an arrow head The wafer 10 made to fix on maintenance hole 11a of the wafer maintenance

fixture 13 and the wafer maintenance fixture 13 rotates in the direction of an arrow head, and while a wafer 10 rotates and revolves around the sun relatively to abrasive cloth 2 as a result, it is ground.
[0008] Moreover, as drawing 5 shows the configuration of other polish equipments, shows the rotary system which combined the sun gear 53 and the internal gear 54 and looks at it to this drawing with this rotation means, the disc-like wafer maintenance fixture 13 is the configuration of making wafer maintenance hole 11a forming, and preparing periphery gear-tooth 13a in a periphery. It engages to the sun gear 53 formed in the core of the bottom rotation surface plate 51 which rotates in the direction of arrow-head A, and the internal gear 54 formed in the outside of this rotation surface plate 51, and a wafer 10 is rotated, making the wafer maintenance fixture 13 rotate and revolve around the sun. This rotary system is used by polish of double-sided polishing, double-sided wrapping, etc., and the turn table (lap surface plate) is used for the up-and-down rotation surface plate at the time of abrasive cloth and wrapping at the time of polishing. Moreover, the wafer maintenance fixture 13 used with this rotary system is also only called a carrier. With this rotary system, although the wafer maintenance fixture (carrier) is carrying out forcible rotation, it is rotating the wafer in a carrier in the same operation as the difference of a centrifugal force, i.e., the phenomenon of the circumference of a companion.
[0009] Now, also in the above mentioned wax free polish equipment, the heterogeneity of the thickness of a backing pad layer reflects the flatness of the wafer after polish, parallelism, etc. as it is like wax polish equipment. Then, the thickness after polish is made to equalize by making a wafer rotate in the wafer maintenance fixture 13 during polish. Therefore, in wax free polish, it is important to make a wafer stabilize and rotate during polish. Therefore, irregularity is attached to a backing pad, and making air, lubricant, etc. intervene between a backing pad and a wafer is performed, and the frictional force of a backing pad and a wafer is reduced.
[0010] However, the frictional force of a backing pad and a wafer is influenced by both surface roughness, frictional force increases, a wafer stops being able to rotate easily, and the display flatness after polish gets worse, so that each surface roughness is large. There are some by which polish recon layers and oxide-film layers, such as PBS (Polyback Seal) and CVD (Chemical Vapor Deposition), were especially formed in the wafer side, and it has granularity different, respectively. The same of it being desirable making a wafer rotate is said of double-sided polish and double-sided wrapping.
[0011]
[Problem(s) to be Solved by the Invention] In this wax free polish equipment, only a polish head and a carrier plate rotate and the heterogeneity of backing pad thickness reflects flatness, parallelism, etc. the case in the condition that a wafer does not rotate during polish in a template. namely, the thickness of a wax layer -- 1 micrometer it is -- backing pad thickness amounts to 10-50 micrometers to a thing, and the heterogeneity of those with 100-300 micrometer and backing pad thickness of the effect on display flatness is farther [than wax polish] large, and a problem.
[0012] Moreover, in the polish approach of other rotary systems which rotate while a wafer grinds, if the balance of the location of a wafer maintenance fixture and each polish (polishing) head is bad, rotation of a wafer maintenance fixture will become unstable. In order to manufacture a wafer with sufficient display flatness as mentioned above, it needs to be stabilized and it is necessary to make the wafer or wafer maintenance fixture which is not made to rotate compulsorily rotate.
[0013] Now, in case the nonwoven fabric of a polyurethane sinking-in polyester nonwoven fabric and others is used for it in case the abrasive cloth (polishing pad) used for said each polish equipment performs for example, primary polishing, and for example, secondary polishing is performed, abrasive cloth of the porosity which consists of two-layer structure of a foaming polyurethane layer (surface) and a polyester layer (lining) is put in practical use. By supplying an abrasive material adequately between a wafer and abrasive cloth, such abrasive cloth is the purposes to which polish efficiency is made to increase, as shown in drawing 2 (B), it is regular intervals at the shape of a grid, and some which use the slot ON abrasive cloth which prepared 20d of slots are in the wafer sliding surface of abrasive cloth 2. (JP,9-201765,A)
[0014] By devising the slot consistency of this slot ON abrasive cloth, this invention aims at offering the wafer polish approach using the polish object and this polish object which consist of the abrasive cloth for wafer polish or the turn table by which the display flatness of a polish wafer is improved by stabilizing a wafer or a wafer maintenance fixture and rotating.
[0015]
[Means for Solving the Problem] Although this invention specifically makes a summary the point of changing the consistency of a slot with the distance from the core of abrasive cloth (polishing pad), and the point to which a slot consistency is made to increase so that it keeps away from the core of abrasive cloth

The invention in this application is performed to the polish approach by which the wafer itself is wanted to rotate efficiently by wax free polish, double-sided polish, etc. Moreover, the polish object of performing recessing same not only about a polishing pad but the turn table at the time of performing wrapping processing (lap surface plate) is good.

[0016] That is, invention according to claim 1 is characterized by making the slot consistency of a part with a large peripheral velocity of this polish object increase to the slot consistency of the part where peripheral velocity is small while it establishes a slot in the wafer sliding surface of said polish object for every predetermined spacing in the polish object which consists of the abrasive cloth or the turn table which grinds this wafer 10, having the relative speed difference and sliding it between wafers 10.

[0017] In the polish object which consists of the above mentioned abrasive cloth or the above mentioned turn table, invention according to claim 2 is characterized by making the slot consistency like this polish object periphery flank increase to the slot consistency located in the inside while it establishes a slot in the wafer sliding surface of said polish object for every predetermined spacing.

[0018] Invention according to claim 3 is characterized by grinding a wafer 10 using the polish object to which the slot consistency of a large part was made to increase the consistency of the slot established in the wafer sliding surface of said polish object to the part where polish object peripheral velocity is small about the wafer polish approach which grinds a wafer 10 using the above mentioned abrasive cloth or the above mentioned turn table according to claim 1.

[0019] the consistency of the slot which invention according to claim 4 established in the wafer sliding surface of said polish object about the wafer polish approach which grinds a wafer 10 using said abrasive cloth or turn table according to claim 2 carried out -- polish -- the inside of the body -- it is characterized by grinding a wafer 10 using the polish object to which received at least the core and the slot consistency of a periphery part was made to increase.

[0020] In the wafer polish approach of invention according to claim 5 pushing against abrasive cloth the wafer stuck on the backing pad by the wax free-lancer (******), and graduating the irregularity of a wafer In order to be stabilized and to make a wafer rotate, it prepares in the wafer sliding surface of said abrasive cloth. It is characterized by grinding a wafer 10 using the abrasive cloth to which the slot consistency was changed in the direction which it is stabilized [direction] and makes a wafer rotate, without making the slot consistency prepared in the wafer sliding surface of said abrasive cloth fixed-ize.

[0021] In the wafer polish approach of taking a wafer 10 and rotating it the surroundings while invention according to claim 6 makes the wafer maintenance fixture held for a wafer 10, enabling free rotation rotating and revolving around the sun relatively to the abrasive cloth stuck on the rotation surface plate It is characterized by grinding a wafer 10 using the abrasive cloth to which the consistency of said slot was changed so that the frictional force which acts in the direction of the circumference of a companion of a wafer might become large, without making the slot consistency prepared in the wafer sliding surface of said abrasive cloth fixed-ize.

[0022] There is an operation the slot on the abrasive cloth rotates [operation] a wafer 10 in the direction of slant to the edge of a wafer 10. However, the slot which the directions of this operation differed by whether a slot is equivalent to which part of an edge, and hit the periphery side (side with a large relative velocity) of abrasive cloth acts in the direction of the circumference of a companion, and the slot which hit the core side (side with a small relative velocity) of abrasive cloth acts on the direction of the circumference of a companion, and hard flow. Therefore, the smooth circumference rotation of a companion is attained the periphery side (side with a large relative velocity) of abrasive cloth by carrying out dense [of the slot consistency of a part] (increment) from the slot consistency by the side of the core of abrasive cloth (side with a small relative velocity).

[0023] If it is ** at the shape of a ring, a slot consistency to abrasive cloth like claim 7 publication therefore, with ** So that between about a dense slot may be relatively straddled with a **** slot to two or more wafers held at wafer maintenance fixtures, such as a carrier, having no wafer 10 fang furrow located in a core side, or relatively The circumference rotation of a companion and display-flatness-izing of the much more desirable wafer 10 are attained by setting up slot spacing, respectively so that the wafer 10 located outside may straddle between about a dense slot relatively with a **** slot.

[0024]

[Embodiment of the Invention] Hereafter, with reference to a drawing, the suitable operation gestalt of this invention is explained in detail in instantiation. However, the dimension of the component part indicated by this operation gestalt, the quality of the material, a configuration, its relative arrangement, etc. are not the meaning that limits the range of this invention to it but only the mere examples of explanation, as long as

there is no specific publication especially.
[0025] Drawing 1 is an example of the shape of a quirk the slot consistency formed on the wafer sliding surface of abrasive cloth (polishing pad) 2 was made to increase, so that it kept away from core grade to a periphery side. (A) is an example of a grid-like slot consistency and, as for slot-less 20f and its outside 21b, at least 21f only of cores is set as dense slot 20a, as for ******20b and outermost 21a. In fact, the ring round part with a core near slot nothing and near a core prepares the slot of the consistency of the non-dense of 40mm angle, and forms in abrasive cloth (polishing pad) with a diameter of 1.4m the slot where 10mm angle is dense on the outskirts. The thickness of abrasive cloth (polishing pad) is 1-1.5mm, and a slot is 2-3mm in a depth of 0.5-1mm, and width of face. Although these slots are formed by cutting abrasive cloth (polishing pad), they may be formed with a press.
[0026] (B) is perpendicular drawing of longitudinal section of the above (A), and, as for an arrow head A, shows the hand of cut of the wafer maintenance fixture which fits in a wafer 10, enabling free rotation, and the hand of cut of a wafer 10 to which an arrow head C is taken about, respectively, as for the hand of cut of abrasive cloth 2, and an arrow head B.
[0027] The much more desirable wafer 10 takes at least a non-dense slot by setting up slot spacing, respectively so that the wafer 10 located outside may straddle between 20a at least for 20b and a dense slot, a time is carried out, and rotation and display flatness-ization are attained so that than this Fig. and at least 20f of wafer-10-fang-furrow-less parts and the non-dense slot which are located in the core side held at the wafer maintenance fixture may straddle between 20b.
[0028] While drawing 2 shows the abrasive cloth concerning other examples and forming a slot in concentric circular and a radial, the core is set as slot-less 20f and slot 20a with the outside dense [******20b and an outermost part]. Moreover, as at least 20f of wafer-10-fang-furrow-less parts and the non-dense slot which are located in the core side held at the wafer maintenance fixture straddle between 20b, and the wafer 10 located outside straddles [20b and a dense slot] between 20a at least as for a non-dense slot, it is as having also described having set up slot spacing, respectively above.
[0029] According to this operation gestalt, the slurry fang furrow 20 (20a, 20b) which intervenes between a wafer 10 and abrasive cloth 2 extrudes by forming such a slot in abrasive cloth 2. Therefore, it comes to contact abrasive cloth 2, without a wafer 10 losing touch with abrasive cloth 2 by hydroplaning, and frictional force increases. If the periphery side of abrasive cloth 2 makes the consistency of a slot 20 high, although this frictional force acts all over a wafer, a wafer or a wafer maintenance fixture will be taken and it will become easy for the frictional force which a wafer 10 and abrasive cloth 2 become easy to contact, and acts in the direction of the circumference of a companion to become large, and to carry out it the surroundings. The effectiveness of this invention was taken, it ground with surroundings-type polish equipment, and the check was carried out.
[0030] First, in the example, abrasive cloth (polishing pad) was formed with the nonwoven fabric, and specifically used Suba600 (Rodel Nitta CO. make). In the abrasive cloth (polishing pad) 2 with a diameter of 1400mm, as shown in drawing 2 (A), the core - the diameter of 470mm formed slot 20c of 40mm angle, the diameter of 470-1200mm formed slot 20b of 20mm angle, and the diameter of 1200-1400mm formed slot 20a of 10mm angle. A slot is 3mm in a depth of 0.7mm, and width of face, respectively. A wafer maintenance fixture is the thing with a diameter of 565mm which can prepare five 8 inch wafers. The wafer 10 used the thing in which PBS was formed at the rear face. These were ground on condition that polish load 240 g/cm2, surface plate rotational-speed 35rpm, and polish time amount 15min.
[0031] (Example of a comparison) Abrasive cloth was formed with the nonwoven fabric, specifically used Suba600 (Rodel Nitta CO. make), took it like the example, and ground with surroundings-type polish equipment. And as shown in drawing 2 (B), in abrasive cloth with a diameter of 1400mm, 20d of styles of 20mm angle was formed by the uniform consistency. 20d of slots is 3mm in a depth of 0.7mm, and width of face, respectively. The wafer maintenance fixture 13 is the thing with a diameter of 565mm which can prepare five wafers. The wafer 10 used the thing in which the PBS layer was formed at the rear face. These were ground on condition that the same polish load 240 g/cm2 as an example, surface plate rotational-speed 35rpm, and polish time amount 15min.
[0032] When the display flatness of an example and the example of a comparison is evaluated, in the example of a comparison, he can understand that total display flatness (Total Thickness Variation:TTV) has improved in 3.5 micrometers and the example as sharply [total display flatness] as 1.0 micrometers. Moreover, the display flatness configuration is shown in drawing 3 . The electrostatic-capacity type wafer display flatness measuring device performed this evaluation. In the example shown in (A), only the configuration which inclined aslant was acquired to an almost level configuration being acquired by the

example of a comparison shown in (B) so that more clearly than this Fig. That is, by grinding using the polish object of this invention shows that a wafer rotates efficiently, it is ground in a form symmetrical with rotation, and a wafer with sufficient display flatness is obtained in an almost level configuration.

[0033]

[Effect of the Invention] According to this invention, by stabilizing a wafer or a wafer maintenance fixture and rotating, the display flatness of a polish wafer is improved like a publication above. In addition, since it is not restricted to this example and a wafer also rotates double-sided polishing and wrapping within a carrier, this invention is effective. Moreover, although the example showed the example of the batch type processed to two or more sheet coincidence, the effectiveness same as the single-wafer-processing wax free polish to which the center of rotation of a polishing head and 1 ** of centers of rotation of a wafer were carried out is acquired. Moreover, the wafer maintenance fixture itself can be efficiently rotated by using the polish object of this invention for a wafer maintenance fixture (plate for polish) also by the approach which stuck the wafer with the wax, and the same effectiveness is acquired.

[Translation done.]

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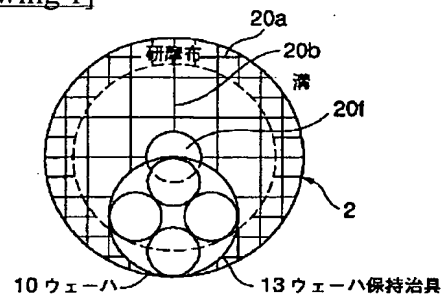
DRAWINGS

[Drawing 1]

(A)



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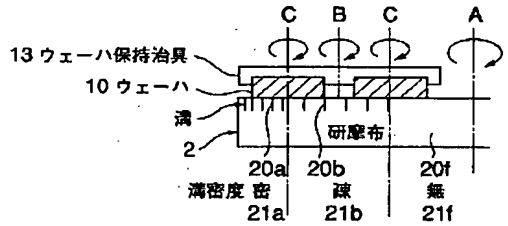

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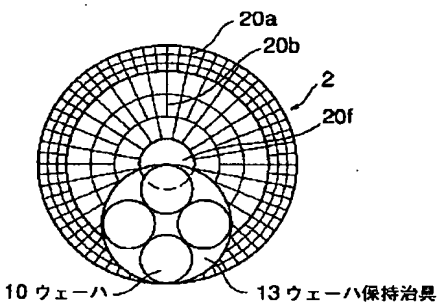
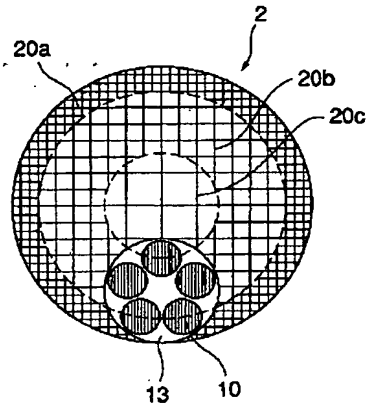


[Drawing 2]

(A)



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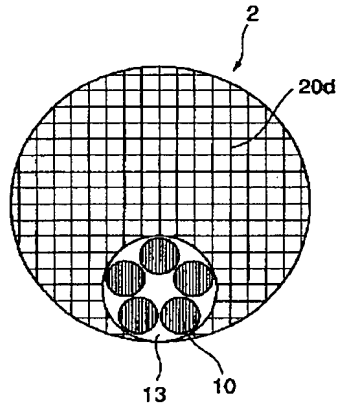

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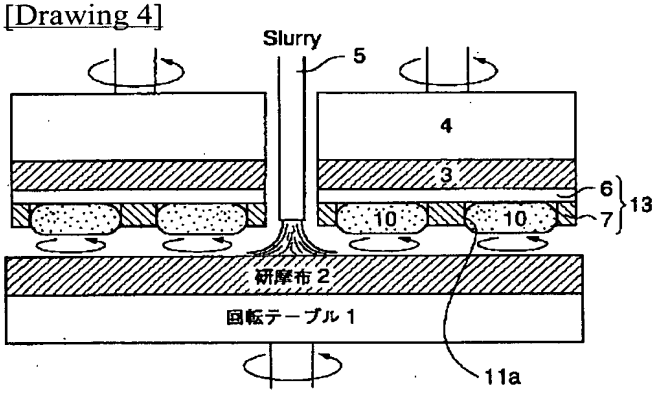
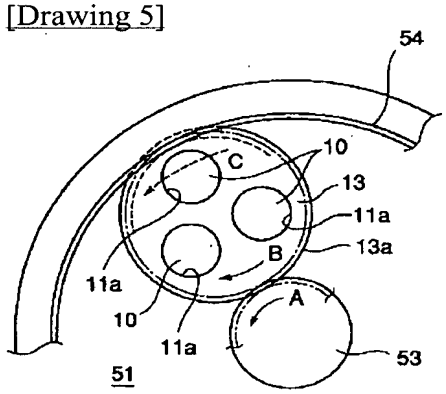
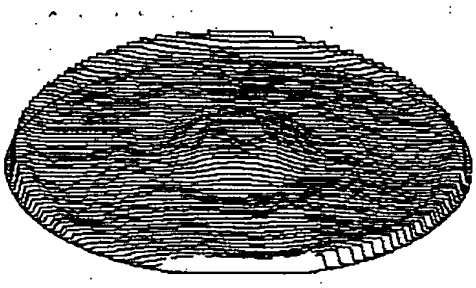


[Drawing 5]



[Drawing 3]

(A)



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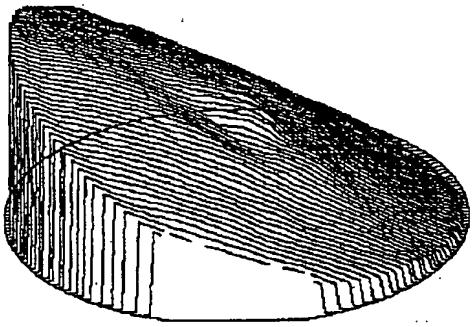

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(11)Publication number : 11-285963
(43)Date of publication of application : 19.10.1999

(51)Int.Cl. B24B 37/00
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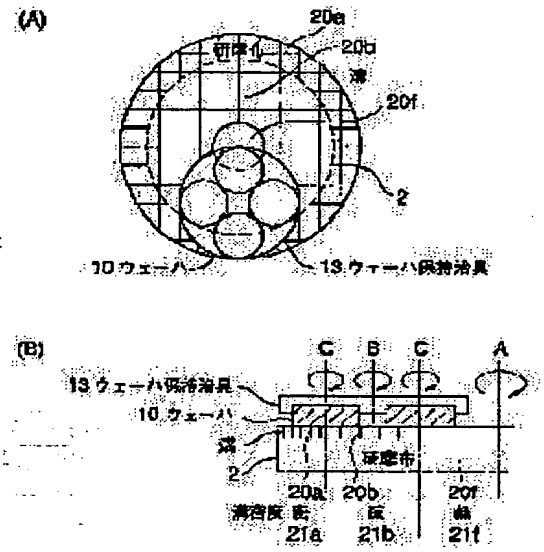
(54) POLISHING BODY COMPOSED OF WAFER POLISHING CLOTH OR POLISHING SURFACE PLATE AND WAFER POLISHING METHOD USING SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To improve flatness of a polished wafer by providing grooves on a wafer sliding surface of a polishing body for every specified intervals, and increasing a density of the groove at a portion where a circumferential speed is high rather than a density of the groove at a portion where a circumferential speed is low.
SOLUTION: A density of groove formed on a wafer sliding face of a polishing cloth 2 is increased from a center 21 toward a peripheral edge. In this lattice-shaped groove density, setting is made such that the center 21 has no groove 20f, a portion outside thereof 21b has a non-dense groove 20b, and an outermost portion has a dense groove 20. Intervals between the grooves are set such that a wafer 10 positioned at a center side retained by a wafer holding jig spans between the grooveless portion 20f and the non-dense groove portion 20b, and a wafere positioned at an outer side spans between the non- dense groove portion 20b and the dense groove portion 20a. Accordingly, a more desirable following rotation of wafer 10 and surface flatness thereof are attained.



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[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2004-09329
[Date of requesting appeal against examiner's decision of rejection]	06.05.2004
[Date of extinction of right]	

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－285963

(43)公開日　平成11年(1999)10月19日

(51)Int.Cl.[6]		識別記号	FI		
Ｂ２４Ｂ	37/00		Ｂ２４Ｂ	37/00	Ｃ
	37/04			37/04	Ａ
Ｈ０１Ｌ	21/304	６２２	Ｈ０１Ｌ	21/304	６２２Ｆ

審査請求　未請求　請求項の数７　ＦＤ　（全７頁）

(21)出願番号　特願平10－103934

(22)出願日　平成10年(1998)３月31日

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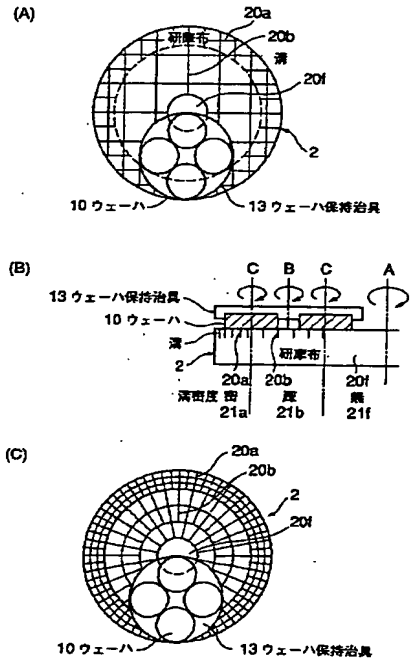
(54)【発明の名称】　ウェーハ研磨用研磨布若しくは研磨定盤からなる研磨体及び該研磨体を用いたウェーハ研磨方法

(57)【要約】

【解決手段】　研磨布のウェーハ摺動面に設けた溝密度を一定化させることなく、ウェーハの連れ回り方向に作用する摩擦力が大きくなるように前記溝密度を変化させ、研磨布中心部位に対し周縁部位の溝密度を増加させたことを特徴とする。

【効果】　ウェーハまたはウェーハ保持治具が安定して自転することにより、研磨ウェーハの平坦度が改善される。



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【特許請求の範囲】

【請求項１】　ウェーハとの間で相対的速度差をもって摺動させながら該ウェーハの研磨を行なう研磨布若しくは研磨定盤からなる研磨体において、

前記研磨体のウェーハ摺動面に所定間隔毎に溝を設けると共に、該研磨体の周速度が大きい部位の溝密度を、周速度が小さい部位の溝密度に対し増加させたことを特徴とするウェーハ研磨用研磨体。

【請求項２】　ウェーハとの間で相対的速度差をもって摺動させながら該ウェーハの研磨を行なう研磨布若しくは研磨定盤からなる研磨体において、

前記研磨体のウェーハ摺動面に所定間隔毎に溝を設けると共に、該研磨体周縁側部位の溝密度を、その内側に位置する溝密度に対し増加させたことを特徴とするウェーハ研磨用研磨体。

【請求項３】　ウェーハと研磨布若しくは研磨定盤からなる研磨体との間で相対的速度差をもって摺動させながら該ウェーハの研磨を行なうウェーハ研磨方法において、

前記研磨体のウェーハ摺動面に設けた溝の密度を、研磨体周速度が小さい部位に対し大きい部位の溝密度を増加させた研磨体を用いてウェーハの研磨を行なうことを特徴とするウェーハ研磨方法。

【請求項４】　ウェーハと研磨布若しくは研磨定盤からなる研磨体との間で相対的速度差をもって摺動させながら該ウェーハの研磨を行なうウェーハ研磨方法において、

前記研磨体のウェーハ摺動面に設けた溝の密度を、研磨体中心部位に対し周縁部位の溝密度を増加させた研磨体を用いてウェーハの研磨を行なうことを特徴とするウェーハ研磨方法。

【請求項５】　バッキングパッドにワックスフリーで貼着したウェーハを研磨布に押し付けてウェーハの凹凸を平滑化するウェーハ研磨方法において、

前記研磨布のウェーハ摺動面に設けた溝密度を一定化させることなく、ウェーハを安定して自転させる方向に溝密度を変化させた研磨布を用いてウェーハの研磨を行なうことを特徴とするウェーハ研磨方法。

【請求項６】　ウェーハを回転自在に保持するウェーハ保持治具を、回転定盤に貼着した研磨布若しくは研磨定盤に対し、相対的に自転且つ公転させながらウェーハを連れ回り回転させるウェーハ研磨方法において、

前記研磨布若しくは研磨定盤のウェーハ摺動面に設けた溝密度を一定化させることなく、ウェーハの連れ回り方向に作用する摩擦力が大きくなるように前記溝の密度を変化させた研磨体を用いてウェーハの研磨を行なうことを特徴とするウェーハ研磨方法。

【請求項７】　研磨体にリング状に溝密度を異ならすと共に、ウェーハ保持治具に保持された複数のウェーハに対して中心側に位置するウェーハが溝なし若しくは相対

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的に疎な溝部位と相対的に密な溝部位との間を跨ぐように、外側に位置するウェーハが相対的に疎な溝部位と相対的に密な溝部位との間を跨ぐように、夫々溝間隔を設定したことを特徴とするウェーハ研磨方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ウェーハ、特に半導体ウェーハ、単結晶シリコンウェーハ研磨用の研磨布若しくは研磨定盤からなる研磨体及び該研磨体を用いたウェーハ研磨方法に関する。

【０００２】

【従来の技術】一般に、ウェーハは円筒状のインゴットをスライス切断、面取りを行なった後、研磨（ラップ）定盤とアズカットウェーハを砥粒を含む研磨液を介して摺擦させながらラッピングを行ない、そして該ラッピングされたウェーハはエッチング処理された後、仕上げ加工工程に導かれる。仕上加工工程においては、研磨（ポリッシング）布とウェーハ間にSiO_2系微粒子を弱アルカリ液中に懸濁させたポリッシング液を用い、いわゆる化学機械的研磨法により鏡面研磨される。

【０００３】この鏡面研磨では、ウェーハを保持する方法として、研磨用プレートにウェーハ片面をウェーハ接着用のワックスを用い貼り付けるワックス法があるが、かかるワックス法においては、接着層（ワックス層）の厚さの不均一性がそのまま、研磨後ウェーハの平面度、平行度等を反映するため、接着層厚を均一にすることが重要である。また、ウェーハ研磨後にウェーハからワックスを除去する必要があるため、工程が複雑になり、またワックスの塗付や除去に使用する薬液、及び廃液処理設備が必要となるので、加工コストが上がるという問題点があった。

【０００４】ワックスレス法は上記ワックス法の欠点を解消したもので、真空吸着による第１のワックスレス法と、多孔質の樹脂、例えばポリウレタン樹脂多孔質体からなるバッキングパッドを用いてウェーハを水貼りする第２のワックスレス法とが利用されているが、いずれも前記したウェーハに対するワックスの塗布、除去が不要になる長所がある。

【０００５】バッキングパッドを用いたワックスフリー研磨装置は、図４に示すように、研磨布２（ポリッシングパッド）を貼着した下側回転テーブル１と、下面側にキャリアプレート３、バッキングパッド６を介して、複数のウェーハ位置決め用穴（保持孔）１１ａにウェーハ１０が保持されたウェーハ保持治具１３が取り付けられた複数のポリッシングヘッド４と、前記研磨布２にスラリー（研磨懸濁液）を供給するスラリー管５からなり、ウェーハ１０を回転テーブル１側の研磨布２に押し付けてウェーハの凹凸を平滑化する研磨装置である。

【０００６】そしてかかる装置に用いるウェーハ保持治具１３は、キャリアプレート３上に１個以上のウェーハ

位置決め用穴１１ａを有するテンプレート７を用い、位置決め用穴にバッキングパッド６が入り、固着させるように形成されている。またテンプレート７は、ガラスエポキシ樹脂、ポリカーボネートシート、ポリエステルシート等から形成されており、またバッキングパッド６は多孔質の樹脂、例えばポリウレタン樹脂多孔質体から形成されている。

【０００７】そしてポリッシングヘッド４は、研磨布２を貼着した下側回転テーブル１に対し自公転し、ウェーハ１０はウェーハ保持治具１３内で連れ回し回転可能に構成されている。ここで連れ回しとは、回転テーブル１上に他の回転軸を有するウェーハ保持治具１３を置くとウェーハ保持治具の面内で遠心力分布が生じ、遠心力の差によりウェーハ保持治具が自転する現象のことである。即ち、図４においては、回転テーブル１の回転中心に対し、複数のポリッシングヘッド４の回転中心を半径方向に変位した位置に配置し、両者を互いに矢印方向に回転させることにより、ウェーハ保持治具１３及びウェーハ保持治具１３の保持孔１１ａに嵌設させたウェーハ１０は、矢印方向に回転し、結果としてウェーハ１０は研磨布２に対し相対的に自転且つ公転しながら研磨される。

【０００８】又、図５は他の研磨装置の構成を示すもので、太陽歯車５３と内歯車５４とを組合せた回転方式を示し、かかる回転手段では同図に見るように、円盤状のウェーハ保持治具１３はウェーハ保持孔１１ａを形成させ且つ外周に外周歯１３ａを設ける構成である。矢印Ａ方向に回転する下側回転定盤５１の中心に設けた太陽歯車５３と該回転定盤５１の外側に設けた内歯車５４とに噛み合わせ、ウェーハ保持治具１３を自転且つ公転させながらウェーハ１０の回転を行なう。この回転方式は、両面ポリッシングや両面ラッピング等の研磨で用いられ、上下の回転定盤にポリッシングの時は研磨布、ラッピングの時は研磨定盤（ラップ定盤）が用いられている。また、この回転方式で用いられるウェーハ保持治具１３は、単にキャリアとも呼ばれる。この回転方式では、ウェーハ保持治具（キャリア）は、強制自転しているが、キャリア内のウェーハは遠心力の差、つまり連れ回りの現象と同じような作用で回転している。

【０００９】さて前記したワックスフリー研磨装置においてもワックス研磨装置と同様に、バッキングパッド層の厚さの不均一性がそのまま、研磨後ウェーハの平面度、平行度等を反映する。そこで研磨中にウェーハをウェーハ保持治具１３内において自転させることにより、研磨後厚さを平均化させている。したがってワックスフリー研磨においては、研磨中にウェーハを安定して自転させることが重要である。そのためバッキングパッドに凹凸を付けたり、又バッキングパッドとウェーハとの間に空気や潤滑剤等を介在させることが行なわれており、バッキングパッドとウェーハとの摩擦力を低減させている。

【００１０】しかしバッキングパッドとウェーハとの摩擦力は双方の表面粗さに影響され、それぞれの表面粗さが大きいほど摩擦力が増大してウェーハが自転しにくくなり、研磨後の平坦度が悪化する。特にウェーハ裏面にはＰＢＳ（Polyback Seal）やＣＶＤ（Chemical Vapor Deposition）などのポリシリコン層や酸化膜層が形成されたものがあり、それぞれ異なった粗さを有する。両面研磨、両面ラッピング等でも、ウェーハを自転させることが好ましいことは同様である。

【００１１】

【発明が解決しようとする課題】かかるワックスフリー研磨装置において、研磨ヘッド及びキャリアプレートのみ回転し、ウェーハがテンプレート中で研磨中に自転しない状態の場合、バッキングパッド厚さの不均一性が平面度、平行度等を反映する。即ちワックス層の厚さが１μｍであるのに対してバッキングパッド厚さは１００～３００μｍあり、バッキングパッド厚さの不均一性は１０～５０μｍに達し、平坦度への影響はワックス研磨よりも遥かに大きく、問題である。

【００１２】またウェーハが研磨中に自転する他の回転方式の研磨方法においては、ウェーハ保持治具と研磨（ポリッシング）ヘッドそれぞれの位置のバランスが悪いと、ウェーハ保持治具の自転が不安定となる。以上のように平坦度の良いウェーハを製造するためには、強制的に自転させていないウェーハまたはウェーハ保持治具を安定して自転させる必要がある。

【００１３】さて、前記夫々の研磨装置に用いられている研磨布（ポリッシングパッド）は、例えば一次ポリッシングを行なう際に、ポリウレタン含浸ポリエステル不織布その他の不織布を用い、また例えば二次ポリッシングを行なう際に発泡ポリウレタン層（表層）とポリエステル層（裏層）の２層構造からなる多孔質の研磨布が実用化されている。これらの研磨布は、ウェーハと研磨布との間に研磨剤を安定供給することにより、研磨能率を増加させる目的で、図２（Ｂ）に示すように研磨布２のウェーハ摺動面に、格子状に等間隔で、溝２０ｄを設けた溝入研磨布を用いているものもある。（特開平９－２０１７６５号）

【００１４】本発明はかかる溝入研磨布の溝密度の工夫を施すことにより、ウェーハまたはウェーハ保持治具が安定して自転することにより、研磨ウェーハの平坦度が改善されるウェーハ研磨用研磨布若しくは研磨定盤からなる研磨体及び該研磨体を用いたウェーハ研磨方法を提供することを目的とする。

【００１５】

【課題を解決するための手段】本発明は研磨布（ポリッシングパッド）の中心からの距離によって溝の密度を変化させる点、具体的には、研磨布の中心から遠ざかるほど溝密度を増加させる点を要旨とするものであるが、本

願発明はワックスフリー研磨、両面研磨等でウェーハ自身が効率良く回転することが望まれる研磨方法に対して行なわれ、また研磨体はポリッシングパッドのみならず、ラッピング加工を行なう際の研磨定盤（ラップ定盤）についても同様な溝加工を行なうのがよい。

【００１６】即ち、請求項１記載の発明は、ウェーハ１０との間で相対的速度差をもって摺動させながら該ウェーハ１０の研磨を行なう研磨布若しくは研磨定盤からなる研磨体において、前記研磨体のウェーハ摺動面に所定間隔毎に溝を設けると共に、該研磨体の周速度が大きい部位の溝密度を、周速度が小さい部位の溝密度に対し増加させたことを特徴とする。

【００１７】請求項２記載の発明は、前記した研磨布若しくは研磨定盤からなる研磨体において、前記研磨体のウェーハ摺動面に所定間隔毎に溝を設けると共に、該研磨体周縁側部位の溝密度を、その内側に位置する溝密度に対し増加させたことを特徴とする。

【００１８】請求項３記載の発明は、前記した請求項１記載の研磨布若しくは研磨定盤を用いてウェーハ１０の研磨を行なうウェーハ研磨方法に関するもので、前記研磨体のウェーハ摺動面に設けた溝の密度を、研磨体周速度が小さい部位に対し大きい部位の溝密度を増加させた研磨体を用いてウェーハ１０の研磨を行なうことを特徴とする。

【００１９】請求項４記載の発明は、前記した請求項２記載の研磨布若しくは研磨定盤を用いてウェーハ１０の研磨を行なうウェーハ研磨方法に関するもので、前記研磨体のウェーハ摺動面に設けた溝の密度を、研磨体中心部位に対し周縁部位の溝密度を増加させた研磨体を用いてウェーハ１０の研磨を行なうことを特徴とする。

【００２０】請求項５記載の発明は、バッキングパッドにワックスフリー（水貼り）で貼着したウェーハを研磨布に押し付けてウェーハの凹凸を平滑化するウェーハ研磨方法において、ウェーハを安定して自転させるために前記研磨布のウェーハ摺動面に設け、前記研磨布のウェーハ摺動面に設けた溝密度を一定化させることなく、ウェーハを安定して自転させる方向に溝密度を変化させた研磨布を用いてウェーハ１０の研磨を行なうことを特徴とする。

【００２１】請求項６記載の発明は、ウェーハ１０を回転自在に保持するウェーハ保持治具を、回転定盤に貼着した研磨布に対し、相対的に自転且つ公転させながらウェーハ１０を連れ回り回転させるウェーハ研磨方法において、前記研磨布のウェーハ摺動面に設けた溝密度を一定化させることなく、ウェーハの連れ回り方向に作用する摩擦力が大きくなるように前記溝の密度を変化させた研磨布を用いてウェーハ１０の研磨を行なうことを特徴とする。

【００２２】研磨布の溝がウェーハ１０のエッジに対して斜め方向に当たるとウェーハ１０を回転させる作用がある。但しこの作用の方向は溝がエッジのいずれの部分に当たるかによって異なり、研磨布の外周側（相対速度の大きい側）に当たった溝は、連れ回り方向に作用し、研磨布の中心側（相対速度の小さい側）に当たった溝は、連れ回り方向と逆方向に作用する。従って研磨布の外周側（相対速度の大きい側）部位の溝密度を、研磨布の中心側（相対速度の小さい側）の溝密度より密（増加）させることにより円滑な連れ回り回転が可能となる。

【００２３】従って請求項７記載のように、研磨布にリング状に溝密度を異ならすと共に、キャリア等のウェーハ保持治具に保持された複数のウェーハに対して、中心側に位置するウェーハ１０が溝なし若しくは相対的に疎な溝部位と相対的に密な溝部位との間を跨ぐように、外側に位置するウェーハ１０が相対的に疎な溝部位と相対的に密な溝部位との間を跨ぐように、夫々溝間隔を設定することにより、一層好ましいウェーハ１０の連れ回り回転と平坦度化が達成される。

【００２４】

【発明の実施の形態】以下、図面を参照して本発明の好適な実施形態を例示的に詳しく説明する。但しこの実施形態に記載されている構成部品の寸法、材質、形状、その相対的配置等は特に特定的な記載がないかぎりは、この発明の範囲をそれに限定する趣旨ではなく、単なる説明例にすぎない。

【００２５】図１は研磨布（ポリッシングパッド）２のウェーハ摺動面上に形成される溝密度を中心部位から周縁側に遠ざかるほど、増加させた溝形状の一例である。（Ａ）は格子状溝密度の一例で、中心部位２１ｆは溝なし２０ｆ、その外側２１ｂは疎な溝２０ｂ、最外側２１ａは密な溝２０ａに設定してある。実際には、例えば直径１．４ｍの研磨布（ポリッシングパッド）に中心は溝なし、中心付近に近いリング円部は、４０ｍｍ角の疎の密度の溝を設け、周辺では１０ｍｍ角の密な溝を形成する。研磨布（ポリッシングパッド）の厚さは１～１．５ｍｍであり、溝は深さ０．５～１ｍｍ、幅２～３ｍｍである。これらの溝は、研磨布（ポリッシングパッド）を切削することにより形成されるがプレスにより形成してもよい。

【００２６】（Ｂ）は前記（Ａ）の垂直縦断面図で、矢印Ａは研磨布２の回転方向、矢印Ｂはウェーハ１０を回転自在に嵌合するウェーハ保持治具の回転方向、矢印Ｃは連れ回されるウェーハ１０の回転方向を夫々示す。

【００２７】本図より明らかなように、ウェーハ保持治具に保持された中心側に位置するウェーハ１０が溝なし部位２０ｆと疎溝部位２０ｂとの間を跨ぐように、外側に位置するウェーハ１０が疎溝部位２０ｂと密溝部位２０ａとの間を跨ぐように、夫々溝間隔を設定することにより、一層好ましいウェーハ１０の連れ回し回転と平坦度化が達成される。

【００２８】図２は他の実施例にかかる研磨布を示し、溝は同心円状且つ放射状に形成すると共に、中心部位は溝なし２０ｆ、その外側は疎な溝２０ｂ、最外側は密な溝２０ａに設定してある。又ウェーハ保持治具に保持された中心側に位置するウェーハ１０が溝なし部位２０ｆと疎溝部位２０ｂとの間を跨ぐように、外側に位置するウェーハ１０が疎溝部位２０ｂと密溝部位２０ａとの間を跨ぐように、夫々溝間隔を設定してあることも前記した通りである。

【００２９】かかる実施形態によれば、研磨布２にこのような溝を形成することにより、ウェーハ１０と研磨布２との間に介在するスラリーが溝２０（２０ａ，２０ｂ）に押し出される。従ってウェーハ１０はハイドロプレーニング現象により研磨布２から浮き上がることなく研磨布２と接触するようになり、摩擦力が増大する。この摩擦力はウェーハ全面に作用するが、研磨布２の外周側ほど溝２０の密度を高くするとウェーハ１０と研磨布２とが接触し易くなり、連れ回り方向に作用する摩擦力が大きくなってウェーハまたはウェーハ保持治具は連れ回りしやすくなる。本発明の効果を連れ回り式の研磨装置で研磨を行なって、その確認をした。

【００３０】先ず実施例においては、研磨布（ポリッシングパッド）は不織布により形成され、具体的にはＳｕｂａ６００（ロデール・ニッタ株式会社製）を使用した。直径１４００ｍｍの研磨布（ポリッシングパッド）２において、図２（Ａ）に示すように、中心～直径４７０ｍｍは４０ｍｍ角の溝２０ｃを形成し、直径４７０～１２００ｍｍは２０ｍｍ角の溝２０ｂ、直径１２００～１４００ｍｍは１０ｍｍ角の溝２０ａを形成した。溝はそれぞれ深さ０．７ｍｍ、幅３ｍｍである。ウェーハ保持治具は８インチウェーハ５枚を仕込むことのできる、直径５６５ｍｍのものである。ウェーハ１０は裏面にＰＢＳを形成したものを使用した。これらを研磨荷重２４０ｇ／ｃｍ²、定盤回転速度３５ｒｐｍ、研磨時間１５ｍｉｎの条件で研磨した。

【００３１】（比較例）研磨布は不織布により形成され、具体的にはＳｕｂａ６００（ロデール・ニッタ株式会社製）を使用し、実施例と同様に連れ回り式の研磨装置で研磨を行なった。そして図２（Ｂ）に示すように、直径１４００ｍｍの研磨布において２０ｍｍ角の構２０ｄを均一な密度で形成した。溝２０ｄはそれぞれ深さ０．７ｍｍ、幅３ｍｍである。ウェーハ保持治具１３はウェーハ５枚を仕込むことのできる、直径５６５ｍｍのものである。ウェーハ１０は裏面にＰＢＳ層を形成したものを使用した。これらを実施例と同一の研磨荷重２４０ｇ／ｃｍ²、定盤回転速度３５ｒｐｍ、研磨時間１５ｍｉｎの条件で研磨した。

【００３２】実施例と比較例の平坦度を評価したところ、比較例では全平坦度（Total Thickness Variation：TTV）が３．５μｍ、実施例では全平坦度が１．０μｍと大幅に改善していることが理解できる。又図３にその平坦度形状を示す。この評価は静電容量式ウェーハ平坦度測定装置により行なった。本図より明らかなように、（Ａ）に示す実施例ではほぼ水平な形状が得られるのに対し、（Ｂ）に示す比較例では斜めに傾斜した形状しか得られなかった。即ち本発明の研磨体を用いて研磨することによりウェーハが効率良く回転し、回転対称な形で研磨され、ほぼ水平な形状で平坦度の良いウェーハが得られることが分かる。

【００３３】

【発明の効果】以上記載のごとく本発明によればウェーハまたはウェーハ保持治具が安定して自転することにより、研磨ウェーハの平坦度が改善される。なお、本発明は本実施例に限られるものではなく両面ポリッシングやラッピング等でも、キャリア内でウェーハが回転するため効果がある。また実施例では複数枚同時に処理するバッチ式の例を示したが、ポリッシングヘッドの回転中心とウェーハの回転中心を一到させた枚葉式ワックスフリー研磨でも同じ効果が得られる。また、ウェーハ保持治具（研磨用プレート）にウェーハをワックスで貼り付けた方法でも、本発明の研磨体を用いることでウェーハ保持治具自体を効率良く回転させることができ、同様な効果が得られる。

【図面の簡単な説明】

【図１】本発明の実施形態にかかる研磨布の溝形状を示し、（Ａ）は格子状溝の一例で、（Ｂ）は前記（Ａ）の垂直縦断面図、（Ｃ）は同心円と放射形状からなる溝の一例を示す。

【図２】本発明の効果確認の実験に用いた研磨布の溝形状を示し、（Ａ）は実施例、（Ｂ）は比較例である。

【図３】実施例（Ａ）と比較例（Ｂ）の平坦度形状を示す

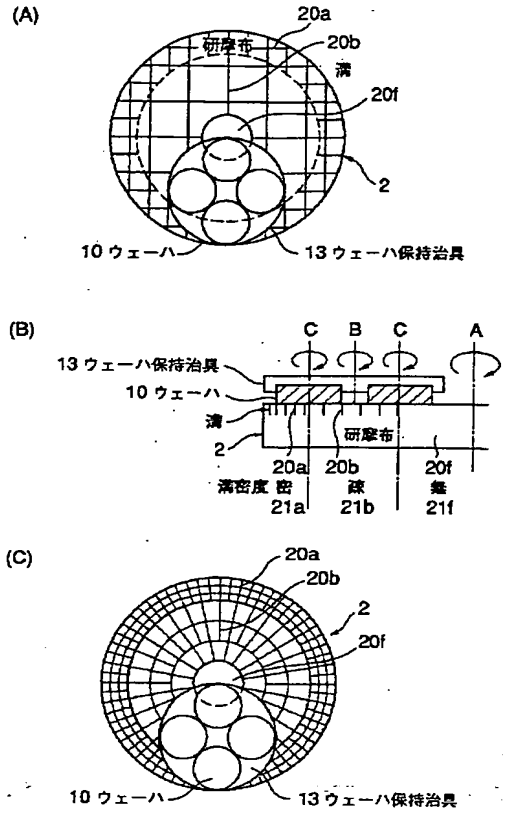
【図４】バッキングパッドを用いたワックスフリー研磨装置を示す。

【図５】太陽歯車と内歯車とを組み合せたウェーハ回転方式の研磨装置を示す。

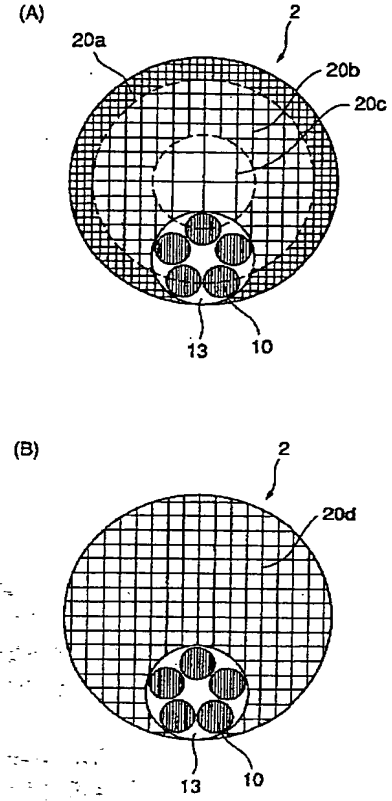
【符号の説明】

２　研磨布
１０　ウェーハ
１３　ウェーハ保持治具
２０　溝

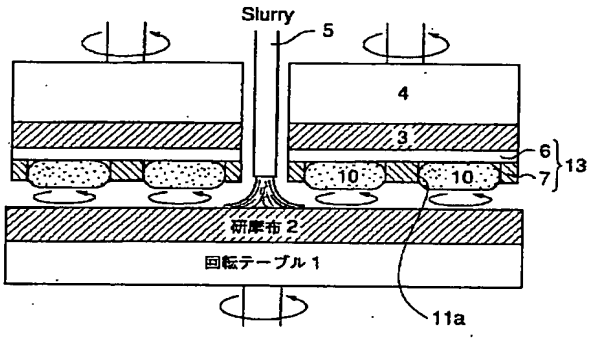
【図１】


(A)
20a
研摩布
20b
溝
20f
2
10 ウェーハ
13 ウェーハ保持治具
(B)
C
B
C
A
13 ウェーハ保持治具
10 ウェーハ
溝
2
研摩布
20a
20b
20f
溝密度 密
疎
21a
21b
21f
(C)
20a
20b
2
20f
10 ウェーハ
13 ウェーハ保持治具

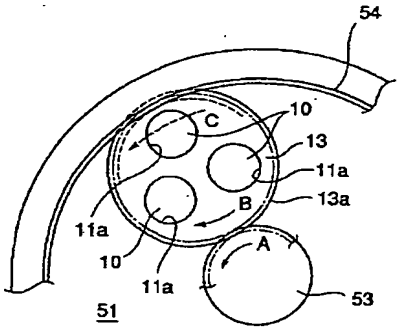
【図２】


(A)
2
20a
20b
20c
13
10
(B)
2
20d
13
10

【図４】

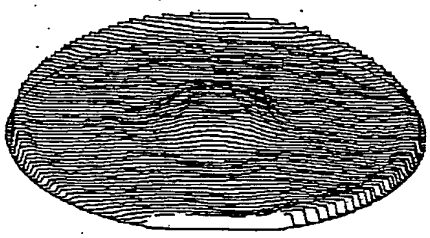

Slurry
5
4
3
6
7
13
10
10
研摩布 2
回転テーブル 1
11a

【図５】


54
C
10
13
11a
13a
B
11a
10
11a
A
53
51

【図３】

(A)



(B)